THE CHLORIDE ION IN THE HEMOLYMPH OF THE LARGE MILKWEED BUG, *ONCOPELTUS FASCIATUS* (DALLAS)

BY

JANET LORRAINE COOPER RAPP

B.Sc., New Jersey College for Women, 1943
M.S., University of Illinois, 1945

AN ABSTRACT OF A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN ENTOMOLOGY
IN THE GRADUATE COLLEGE OF THE
UNIVERSITY OF ILLINOIS, 1948

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Introduction

Although the literature contained several references concerning the amount of chloride ion in the hemolymph of various species of insects, only one species, *Dytiscus marginalis* Linné, had been studied as an adult and no attempt had been made to study different stages or instars of the same insect. Most of the investigators bled a great many insects to obtain a sufficiently large sample or chose a larva or pupa of a species with complete metamorphosis relatively rich in hemolymph. Probably the reason that such a few species have been so studied is that a great deal of time can be expended in merely bleeding specimens. For this reason, much of the time given to this problem was spent in perfecting a method which was fairly rapid and required only a relatively few insects for one sample of hemolymph.

Review of Literature

Six investigators, Babers (1938), Bishop, Briggs, and Ronzoni (1925), Brecher (1929), Heller and Moklowska (1930), Portier and Duval (1927), and Wigglesworth (1938), had reported on the chloride content of the hemolymph of 13 species of insects. Nine of the analyses were run on species of Lepidoptera; one, on a species of Hymenoptera; one, on a species of Coleoptera; and two, on species of Diptera.

Method of Study

Various methods of analysis, including Wigglesworth's (1937) special modification of Volhard's classical method of volumetric analysis for chloride, were tried. The method ultimately used consisted of a D. C. vacuum-tube voltmeter used in conjunction with a potentiometric circuit in which the indicator electrode was of silver wire and the so-called reference electrode of tungsten wire. Silver nitrate was added to the sample by means of a special microburette. The end point was detected by the "break" or "jump" in

potential due to the relationship of the electrodes to the solution as measured by the vacuum-tube voltmeter. The greatest change in potential per volume of silver nitrate added served to indicate the end point of the titration. Chloride determinations were run on the whole hemolymph of adults, both male and female, and on all five instars of the nymphs of the large milkweed bug, *Oncopeltus fasciatus* (Dallas). Analyses for chloride were also made on the plasma of the adults and the fifth instar nymphs of the same species.

Results

	No. of Samples	Mean Amt. Cl^- Milligrams/ 100 Ml.	Mean Deviation	Standard Deviation	Standard Error of Standard Deviation
Chloride in Whole Hemolymph of Adults—Male and Female	25	91.4	±0.114	0.0689	0.00975
Chloride in Whole Hemolymph of Male Adults	10	91.2	±0.007	0.138	0.0309
Chloride in Whole Hemolymph of Female Adults	10	91.1	±0.012	0.141	0.0315
Chloride in Whole Hemolymph of Fifth Instar Nymphs	10	91.5	±0.026	0.332	0.0743
Chloride in Whole Hemolymph of Fourth Instar Nymphs	10	91.5	±0.027	0.336	0.0751
Chloride in Whole Hemolymph of Third Instar Nymphs	10	91.4	±0.009	0.257	0.0575
Chloride in Whole Hemolymph of Second Instar Nymphs	10	91.2	±0.008	0.367	0.0821
Chloride in Whole Hemolymph of First Instar Nymphs	10	91.2	±0.007	0.202	0.0452
Chloride in Plasma of Adults	10	142.9	±0.008	0.494	0.111
Chloride in Plasma of Fifth Instar Nymphs	10	143.0	±0.009	0.496	0.111

Conclusions

1. A potentiometric method, utilizing a bimettalic system of electrodes and a vacuum-tube voltmeter was developed for measuring the chloride ion content of a micro sample of hemolymph with an error of not more than 0.2 per cent down to 0.03546 micrograms of chloride per microliter.

2. The chloride ion content of the hemolymph of the milkweed bug, *Oncopeltus fasciatus* (Dallas), was found to be 6.93 micrograms per 7.58 microliters or 91.4 milligrams per 100 milliliters.

3. No difference was determined in the chloride content of the

hemolymph between the sexes or between the adults and any one of the five instars of nymphs.

4. The chloride ion content of the plasma alone was found to be 10.83 micrograms per 7.58 microliters or 143 milligrams per 100 milliliters.

5. There was no difference between the chloride ion content of the plasma of the adults and the fifth instar nymphs.

6. Assuming that the hemolymph contains more plasma than leucocytes, the hemolymph was considered to be roughly 51 per cent plasma and 49 per cent leucocytes by weight. Making this assumption, at least 96 per cent of the chloride occurred in the plasma.

VITA

The candidate was born, Janet Lorraine Cooper, November 3, 1921, in Newark, New Jersey. Her grade and high school education was obtained in the public schools of Newark. She graduated as Valedictorian of her class from West Side High School in January 1939. In September 1939 she entered New Jersey College for Women, Rutgers University. During the summer of 1942 she was employed as a laboratory assistant by the Department of Entomology of the Connecticut Agricultural Experiment Station, New Haven, Conn. In June 1943 she received the B.Sc. degree with a major in Zoology-Botany from the New Jersey College for Women. From June 1943 until September 1944 she held a National Carbon Fellowship at Rutgers University. Half of her time was spent taking courses in Entomology and the other half was spent doing research on mosquito repellants under the direction of Dr. Philip Granett. In October 1944 the candidate entered the University of Illinois and in June 1945 received the M.S. degree in Entomology. From October 1944 until September 1947 the candidate was a half time assistant in the Department of Botany, except during the summer of 1945 when she was employed by the Illinois Natural History Survey. Since October, 1947, she has held a Graduate College Fellowship in Entomology.

The candidate was married September 30, 1944, to William Frederick Rapp, Jr.

She was elected a member of Sigma Xi in 1947 and is a member of Phi Sigma, the American Association of Economic Entomologists, and the Entomological Society of Ontario.

She has published the following:

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